

WHAT IS CLAIMED IS:

1. A semiconductor device comprising:

a first conductivity type base layer;

5 a second conductivity type base layer selectively  
formed on an upper surface of said first conductivity  
type base layer;

a first conductivity type emitter layer  
selectively formed on a surface of said second  
conductivity type base layer;

10 a gate electrode formed on a part of said second  
conductivity type base layer sandwiched between said  
first conductivity type emitter layer and said first  
conductivity type base layer, with a gate insulating  
film interposed between said second conductivity type  
15 base layer and said gate electrode;

a first conductivity type buffer layer formed on  
a back surface of said first conductivity type base  
layer; and

20 a second conductivity type collector layer formed  
on a back surface of said first conductivity type  
buffer layer, wherein

a requirement of  $d_2/d_1 > 1.5$  is satisfied, where  
 $d_1$  is a depth in said first conductivity type buffer  
layer, as measured from an interface of said first  
25 conductivity type buffer layer and said second  
conductivity type collector layer, at which a  
concentration of a first conductivity type activated

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impurity in said first conductivity type buffer layer shows a peak value, and d2 is a shallowest depth in said first conductivity type buffer layer, as measured from the interface of said first conductivity type  
5 buffer layer and said second conductivity type collector layer, at which an activation ratio of said first conductivity type impurity in said first conductivity type buffer layer is a predetermined value.

10 2. The semiconductor device according to claim 1, wherein said activation ratio is defined by a concentration of activated those of said first conductivity type impurity in said first conductivity type buffer layer/a concentration of said first  
15 conductivity type impurity in said first conductivity type buffer layer.

3. The semiconductor device according to claim 2, wherein said concentration of said activated first conductivity type impurity in said first conductivity type buffer layer is observed by a Spreading Resistance analysis and said concentration of said first  
20 conductivity type impurity in said first conductivity type buffer layer is observed by a Secondary Ion Mass Spectrometry analysis.

25 4. The semiconductor device according to claim 1, wherein said predetermined value for said activation ratio is substantially 0.3 or lower than 0.3.

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5. The semiconductor device according to claim 1, wherein said first conductivity type buffer layer and said second conductivity type collector layer are formed from impurity diffusion layers.

5           6. The semiconductor device according to claim 2, wherein said first conductivity type buffer layer and said second conductivity type collector layer are formed from impurity diffusion layers.

10           7. The semiconductor device according to claim 1, wherein said first conductivity type buffer layer and said second conductivity type collector layer are formed by implanting impurities into and annealing a first conductivity type semiconductor wafer having a substantially uniform impurity concentration.

15           8. The semiconductor device according to claim 2, wherein said first conductivity type buffer layer and said second conductivity type collector layer are formed by implanting impurities into and annealing a first conductivity type semiconductor wafer having a substantially uniform impurity concentration.

20           9. The semiconductor device according to claim 1, wherein

          said first conductivity type base layer, said second conductivity type base layer, said first conductivity type emitter layer, said first conductivity type buffer layer and said second conductivity type collector layer are formed from

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impurity diffusion layers.

10. The semiconductor device according to claim 2,  
wherein

5 said first conductivity type base layer, said  
second conductivity type base layer, said first  
conductivity type emitter layer, said first  
conductivity type buffer layer and said second  
conductivity type collector layer are formed from  
impurity diffusion layers.

10 11. The semiconductor device according to claim 1,  
wherein said first conductivity type base layer, said  
second conductivity type base layer and said first  
conductivity type emitter layer are formed by  
implanting impurities into a first conductivity type  
15 semiconductor wafer having a substantially uniform  
impurity concentration, and said first conductivity  
type buffer layer and said second conductivity type  
collector layer are formed by implanting impurities  
into and annealing said semiconductor wafer.

20 12. The semiconductor device according to claim 2,  
wherein said first conductivity type base layer, said  
second conductivity type base layer and said first  
conductivity type emitter layer are formed by  
implanting impurities into a first conductivity type  
25 semiconductor wafer having a substantially uniform  
impurity concentration, and said first conductivity  
type buffer layer and said second conductivity type

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collector layer are formed by implanting impurities into and annealing said semiconductor wafer.

13. The semiconductor device according to claim 1, wherein said depth d2 is larger than said depth d1.

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